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ABSTRACT

This booklet, one of six in the Living Things Science series, presents activities about ecosystems which address basic "Benchmarks" suggested by the American Association for the Advancement of Science for the Living Environment for grades 3-5. Contents include background information, vocabulary (in English and Spanish), materials, procedures, extension activities, and worksheets. The worksheets are presented in both English and Spanish versions. Suggestions for use of the activities include using student grouping, a related readings center, and journal keeping. Activity names are: "Aquariums and Terrariums," "Bird Watchers," "Yeast and Bread," "Plant Growth in Various Soils," "What's Your Biome?," "Rainforest Scavenger Hunt," "Rotting Logs," "Tea for Plants and Plants for Tea," "The Web," and "Living Together." Lists of fiction and non-fiction reading are included. (MKR)

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INVITATIONS TO INTERDEPENDENCE

CAUGHT IN THE WEB

Teacher Friendly Science Activities

with reproducible handouts in English and Spanish

Grades 3-5

Carole Ann Camp, Editor

LIVING THINGS SCIENCE SERIES

BEST COPY AVAILABLE

INVITATIONS

TO

INTERDEPENDENCE: CAUGHT IN THE WEB

Teacher-Friendly Science Activities

with reproducible handouts in English and Spanish

Grades 3-5

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LIVING THINGS SCIENCE SERIES

Ash Grove Press, Inc.

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Life's Diversity

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Cells: Life's Building Block

Interdependence: Caught in the Web

The Matter-Energy Cycle

Evolving

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INVITATIONS TO CAUGHT IN THE WEB

INTRODUCTION

All organisms rely on their environment for life sustaining activities. The study of the interaction between organisms and their environment is called ecology. Ecology means the study of homes. Factors such as water, oxygen, light, temperature, soil, and inorganic and organic nutrients determine what types of organisms can survive in a given environment. For example, many kinds of trees cannot survive in the desert.

A population is the simplest group of organisms. All the elm trees in a forest make up a population. All the different populations within an area make up the community. All the frogs, fish, algae, and plants in and around a pond make up the pond community.

An ecosystem includes a community plus its physical environment. All the ecosystems of the earth are linked to one another. Organisms, water, and inorganic and organic materials can pass from one ecosystem to another. Materials are used over and over. In an ecosystem each population has its own function. Ecosystems also have a non-living part called the physical environment.

In any ecosystem three types of relationships exist: relationships among members of the living community, relationships between members of the living community and the physical environment, and interactions in the physical environment.

CONCEPTS

Due to the nature of the interdependence of all things, the "invitations" in this book address all of the following concepts at some level. However, some invitations highlight one or more of the concepts. Those concepts will be identified by bold print in the concept section of each "invitation."

- Organisms effect their environment and the environment effects organisms
- Insects and various other organisms depend on dead plant and animal material for food.
- The survival rate of plants and animals is unique for any particular environment.
- Plants and animals depend on each other in many ways.
- Many micro-organisms are beneficial.

SCIENCE JOURNAL

The students are encouraged to keep journals of their observations. They are also encouraged to reflect on these observations as they struggle with the ideas of relating living things to the environment. The students can create their own format for their science journals, or the teacher can suggest a format or use the reproducible pages throughout this book.

CLASSROOM MANAGEMENT

The activities in this INVITATION can be managed in a variety of ways. However, students should have many opportunities to work together in groups of 3-4 students. One of the objectives for this INVITATION is to have students come to understand that there are many ways to see the relationships between living things. By sharing and working together, students will be able to value their fellow students' contributions, as well as begin to realize that the process that they are engaged in is similar to the one scientists use in order to understand these concepts.

If it is possible in your classroom, identify one area, desk or table, as "INVITATIONS TO THE WEB." In this center, include books from the resource list and extension activities.

Many of the activities in this unit are similar in some ways, but focus on different aspects of the subject. All the activities involve many observations over time. You may choose to have all of the students do all of the activities or have each group of students focus on a different activity, sharing observations as they go along.

Some aspects of these "Invitations" are more appropriate for the younger students, while other aspects are better for older students. Teachers should feel free to adapt each activity for their particular students.

RELATED READING FOR INVITATION CENTER

NON FICTION

Animals at the Waters Edge. Madison, New Jersey: Raintree Publishers Staff, 1987.

Animals in Cities and Parks. Madison, New Jersey: Raintree Publishers Staff, 1987.

Animals in the Forest. Madison, New Jersey: Raintree Publishers Staff, 1987.

Animals in the Mountains. Madison, New Jersey: Raintree Publishers Staff, 1987.

Animals in Rivers and Ponds. Madison, New Jersey: Raintree Publishers Staff, 1987.

Arnold, Caroline. *A Walk in the Desert.* Columbus, Ohio: Silber Press, 1990.

Bash, Barbara. *Tree of Life-The World of the African Baobab.* San Francisco: Sierra Club Books, Boston, Little Brown, 1989.

Busch, Phyllis S. *Dining On A Sunbeam: Food Chains And Food Webs.* New York: Four Winds Press, 1973.

Fleischman, Paul. *Joyful Noise: Poems For Two Voices.* Illustrated by Eric Beddows. New York: Trumpet Club, 1988.

Foster, Joanna. *Cartons, Cans, And Orange Peels: Where Does Your Garbage Go?* New York: Clarion Books, 1991.

Heller, Ruth. *Plants Than Never Ever Bloom.* New York: Grosset & Dunlap, 1984

Hogner, Dorothy. *Earthworms.* Illustrated by Nils Hogner. New York: Crowell, 1953.

Kutner, Lynn. *Bountiful Bread.* Illustrated by Maceo Mitchell. New York: I Chalmers Cookbooks, 1982.

Perl, Lila. *Slumps, Grunts and Snickerdoodles: What Colonial America Ate And Why.* Illustrated by Richard Cuffari. New York: Seabury Press, 1975.

Pringle, Laurence. *Animals and Their Niches: How Species Share Resources.* Illustrated by Leslie Morrill. New York: Morran, 1977.

Pringle, Laurence. *The Hidden World - Life Under A Rock.* Illustrated by Erick Ingraham. New York: Macmillan, 1977.

Pringle, Laurence P. *Chains, Webs, And Pyramids: The Flow Of Energy In Nature.* Illustrated by Jan Adkins. New York: Crowell, 1975.

Seymour, Simon. *Discovering What Earthworms Do.* New York: McGraw Hill, 1969.

Shuttleworth, Floyd S. *Non-Flowering Plants.* New York: Golden Press, 1967.

Swenson, Alan A. *The World Beneath Your Feet: Animals That Live Underground.* Illustrated by Donna R. Saboka. D. McKay Co., 1978.

Thomas, M. J. and E. Soothill. *Discovering Birds Of Prey.* Bookwright Press, 1986.

FICTION

Bohdal, Susi. *Bird Adalbert*. Illustrated by Andrew Elborn. Natick, Mass: Picture Book Studio, 1983.

Damanska, Janina. *Little Red Hen*. New York: MacMillan, 1973.

Demarest, Christ. *Benedict Finds A Home*. New York: Lothrop, Lee & Shepard Books, 1982.

DePaola, Tomie. *Watch Out For The Chicken Feet In Your Soup*. Englewood Cliffs, N.J: Prentice-Hall, 1974.

Devlin, Werde. *Cranberry Thanksgiving*. New York: Parents' Magazine, 1971.

Eastman. P.D. *Are You My Mother?* New York: Random House, 1960.

Fleming, Denise. *In The Small, Small Pond*. New York: Henry Holt & Co. 1993.

Flora. *Feathers Like a Rainbow: An American Indian Tale*. New York: Harper Row, 1989.

George, Jean Craighead. *Hook A Fish, Catch A Mountain: An Ecological Spy Story*. New York: Dutton, 1975.

Ginsburg, Mira, comp. *The Lazies: Tales Of The Peoples Of Russia*. Illustrated by Marian Perry. New York: MacMillan, 1973.

Hoban, Russell. *Bread And Jam For Francis*. Illustrated by Lillian Hoban. New York: Harper Row, 1964.

Lionni, Leo. *Theodore And The Talking Mushroom*. New York: Pantheon, 1971.

Luttig, Laura. *Dreamsong*. Illustrated by David Scott Meier. Saxonville, MA: Picture Book Studio, 1988.

McKee, David. *King Rollo And The Bread*. Boston: Little Brown, 1979.

McKissack, Patricia & Frederick. *Bugs!* Illustrated by Clovis Marin. Chicago: Children's Press, 1988.

Nadler, Ellis. *The Bee's Sneeze*. New York: Simon & Shuster Books for Young Readers, 1993.

Parkinson, Ethelyn. *Rubert Piper & The Dear, Dear Birds*. Illustrated by Gloria Kaner. Nashville: Abington, 1976.

Pulver, Robin. *Nobody's Mother Is In The Second Grade*. Illustrated by G. Brian Karas. New York: Dial Books for Young Readers, 1992.

Riddell, Chris. *Bird's New Shoes*, 1st American Ed. New York: H. Holt, 1987.

Selsam, Millicent. *The Bug That Laid The Golden Eggs*. Illustrated by John Daufmann. Photographs by Harold Krieger. New York: Harper & Row, 1967.

Silverstein, Shel. *The Giving Tree*. New York: Harper & Row, 1964.

Yolen, Jane. *The Bird of Time*. Illustrated by Mercer Mayer. New York: Thomas Y. Coswell Co., 1971.

VOCABULARY

The teacher is encouraged to help students develop their own unique set of vocabulary words depending on the student's interest, experience, and ability. The following words are only suggestions and a very small selection of all the possibilities.

adaptation: process by which a species becomes better suited to its environment

adaptación: procesa por media del cual una especie se pone el mas apropiada a su entorno

biome: major type of terrestrial ecological community, such as grassland and desert

biome: el tipo mayor de communidad terrestre ecologica, tal como prado y desierto.

biosphere: portion of the earth in which living things exist

bioesfera: parte de la tierra en que existe organismos vivientes

climate: the average weather conditions of a place over a period of years

clima: las condiciones de clima promedio de un lugar sobre un período de años.

coevolution: situation in which two or more species evolve in response to each other

coevolución: la situación en que dos o mas especies desenvuelven en respuesto uno al otro

commensalism: relationship between two organisms in which one benefits and the other neither benefits nor is harmed

comensalía: la relación entre dos organismos en que uno beneficia y el otro ni beneficia ni esta dañado.

community: all the organisms that live in an ecosystem

comunidad: todos los organismos que viven en una sistema ecologica.

diversity: measure of the number of species living in an ecosystem scaled by how common each species is

diversidad: la medida del número de especies que viven en una sistema

ecology: study of relationships of organisms to their environment

ecología: el estudio de relaciones de organismos a su entorno

ecosytem: a group of organisms and their physical environment and all the interactions between them

condiciones ambientales: un grupo de organismos y su entorno y todas sus interacciónes

environment: everything that surrounds an organism, that is, all the external forces that influence the expression of an organism's heredity

entorno: el medio ambiente de un organismo, es decir, todas la forcas que influencian la expresión hereditaria del organismo

evolution: genetic change in a species over time

evolución: el cambio genético de un especie durante años

fermentation: breakdown of organic compounds such as glucose

fermentación : la ruptura de compuestos orgánicos tal como glucosa

habitat: physical location where an organism lives in an ecosystem

medio: el lugar físico donde vive un organismo en su condicion ambiental.

mutualism: ecological relationship in which all organisms involved benefit

reciprocación: relación ecological en que todos organismos benefician

natural selection: process by which organisms best-suited to their environmental conditions are most likely to survive and reproduce

selección natural: procesa por medio del cual organismos mejor apropiados a sus condiciones ambientales mas probable van a sobrevivir y reproducir

organism: any living thing

organismo: cualquier ser vivo

parasitism: ecological relationship in which one organism lives on or in another organism and absorbs nutrients from it

parasitismo: relación ecological en que un organismo vive en un otro organismo y absorbe nutrientes del mismo

population: the collection of plants and/or animals living in a given area

población: colección de plantas y/o animales que vive en un lugar particular

species: a group of plants or animals that are alike in certain ways

especie: un grupo de plantas o animales que son similares en unas maneras

symbiosis: close, long-term association between two or more species

simbiosis: una asociación íntima y prolongada entre dos o mas especies

INVITATION 1

AQUARIUMS AND TERRARIUMS

BACKGROUND

The interaction of organisms and their environment can be demonstrated by making observations of an environment over a long period of time. A terrarium or fish aquarium or both in the classroom can teach many things about the interaction of living things.

In an aquarium there is much to be learned about the needs of the fish and plants: pH, ammonia, food, waste removal, and water changes.

A classroom terrarium can easily be set up using a 20-gallon aquarium and a few small plants.

The primary objectives of this activity are to help students develop their observation skills and to begin to understand the concept that the survival of organisms is dependent in part on a particular and unique environment.

You may choose to do this activity over several months having students make daily or weekly observations. You may want to have a terrarium and an aquarium so students can compare their observations of each environment.

CONCEPTS

- **Organisms effect their environment and the environment effects organisms.**
- Insects and various other organisms depend on dead plant and animal material for food.
- **The survival rate of plants and animals is unique for any particular environment.**
- Plants and animals depend on each other in many ways.
- Many micro-organisms are beneficial.

MATERIALS

Aquarium

Your local pet store can help you in purchasing the most cost-effective set-up for your classroom. These are the basic items needed:

- 20-gallon aquarium (horizontal type is best)
- Filter (under gravel, corner, etc.)
- Air pump
- Air hose
- Gravel or small stones
- Plastic plants or decorations
- Fish. Try to get one bottom-feeder (catfish) to help keep the tank clean, as well as a couple other community fish. Your pet store can help you choose these.

Terrarium

- Dirt
- Sphagnum moss
- Humus
- Salamanders (optional)
- Plastic wrap
- Seeds and small plants, specifically those adapted to a humid evironment
- Grass seed
- 10-20 gallon aquarium

PROCEDURE

Terrarium and Aquarium

1. Thoroughly clean the container.
2. Cover the bottom of the terrarium with a layer of gravel, sand or stones. This is needed for proper drainage and aeration of the roots of the plants.

3. Cover the bottom layer with two inches of dirt.
4. Make several small depressions in the soil for the roots of the plants and place them in the depressions.
5. Plant a variety of seeds. Grass seeds give speedy growth and will act as ground cover in the terrarium.
6. Water gently and cover tightly with plastic wrap.
7. Place in light appropriate to plants selected.
8. Set up the aquarium using guidelines provided by your local pet store.
9. Make observations of both the aquarium and terrarium several times a week.
10. Compare and contrast the changes taking place in each ecosystem.

QUESTIONS FOR DISCUSSION OR JOURNAL REFLECTION

1. What happened to the plants that died?
2. What happened to the fish that died?
3. What is nourishing the new plant life?
4. How do dying and decaying support new life?
5. What organisms thrived in this environment? Which ones did not? Why?

EXTENSION ACTIVITIES

- Take a field trip to a nearby bog or desert or other ecosystem. Observe the process of dying, decaying, and re-birth in this system. Compare and contrast observations with those in the terrarium.
- Build a compost or individual mini-composts. Plant seeds in soil fertilized by composted materials.
- Take a field trip to a greenhouse.
- Invite a guest speaker such as a botanist, forest service person, naturalist, or organic farmer to share their work with the class.

INVITATION 2

BIRD WATCHERS

BACKGROUND

The way that a bird feeds can be peculiar to a species. Some birds kick the seed onto the ground and eat from there. Others eat only at the feeder after they chase other birds away. By watching the behavior of birds, students will begin to recognize that different types of birds have their own unique feeding patterns.

In addition to unique feeding patterns, birds of a similar kind often build nests that are similar. However, nests also reflect material that is available. It is interesting to note that a robin's nest in Maryland looks similar to a robin's nests in Maine even though the actual building materials are different. Also, birds often do not follow the rules, and some nests reflect the individual tastes of an individual bird. Most birds build new nests each year. Some birds that have more than one brood a year will have a nest for each brood. Some birds use the same nest year after year. Some nests are built by the females, some by the males, and some by both.

CONCEPTS

- **Organisms effect their environment and the environment effects organisms.**
- Insects and various other organisms depend on dead plant and animal material for food.
- **The survival rate of plants and animals is unique for any particular environment.**
- Plants and animals depend on each other in many ways.
- Many micro-organisms are beneficial.

MATERIALS

- Bird feeders
- Sunflower or thistle seeds
- Wild bird seed mixture
- One-liter plastic soda bottle for each student plus 2-4 for the class
- 1/4 inch dowel.
- Copies of pages 11-16
- 5-7 birds' nests (different kinds of nests, if possible)
- Material similar to that found in nests
- Magnifying glasses
- Materials worksheet

PROCEDURE

Part 1: Soda bottle bird feeder

1. Clean the bottle and remove the label and the bottom plastic base if it has one.
2. Put 1/4 liter of bird seed into the bottle. Cap. Turn it over. Mark the top of the seed with a 1/4 mark. Repeat, adding 1/4 liter more seed. Mark the top. Repeat by quarters until the bottle is full. See the diagram on page 10.
3. Remove the seeds. Punch sets of holes near the neck of the soda bottle so that a piece of dowel can be inserted through the bottle to act as a perch.
4. Near the perches, punch holes for feeding. The holes should be only the size of the seeds.
5. Bore hole through the bottom of the bottle. Insert a small dowel tied with a string
6. Refill the bottle through the top, and put the cap on; hang it upside down from a tree branch. The feeders should be hung in a location that will allow for easy observation from indoors.

7. Place several feeders close to one another, each with a different kind of seed.
8. Record observations at the same time every day.
9. From a bird guide for your region, make copies of the birds that are commonly seen during the time that observations will take place. The students will be able to use these to identify the birds that come to the feeders. Your local birding club is also a very good resource. NOTE: Morning is the best time to observe birds .
10. Divide the number of students by the number of feeders. Have pairs of students from each group make 15 minute observations for a given feeder. Students can help each other verify types of birds seen.
11. Record the different number of birds that come to the feeders in a given amount of time. Start these observations several days after the feeders have been established.
12. Have the students make bird feeders for home.
13. In their journals, have the students record observations using page 15 or 16.
14. Have students compare their observations with other classmates.

Part 2: Birds' nests

1. Obtain 5-7 birds' nests. In some locations obtaining 5-7 birds' nests may be difficult. A local science center or environmental center may be able to loan the nests to you.
2. Distribute one nest to each group of four students. Do not destroy the nests.
3. In their journals, have students record observations. Students should wash their hands after touching the nests.
4. Make a group list of materials found in the nests and possible sources for these materials.
5. As a class, compare lists of each group.
6. Predict the length of time it takes a bird to build a nest.
7. Give each student or group of students material to make a nest. Have students try to make nests.
8. Research nest building by a variety of different kinds of birds. Be sure to tell students that only fallen nests should be investigated. Nests in place should not be disturbed.

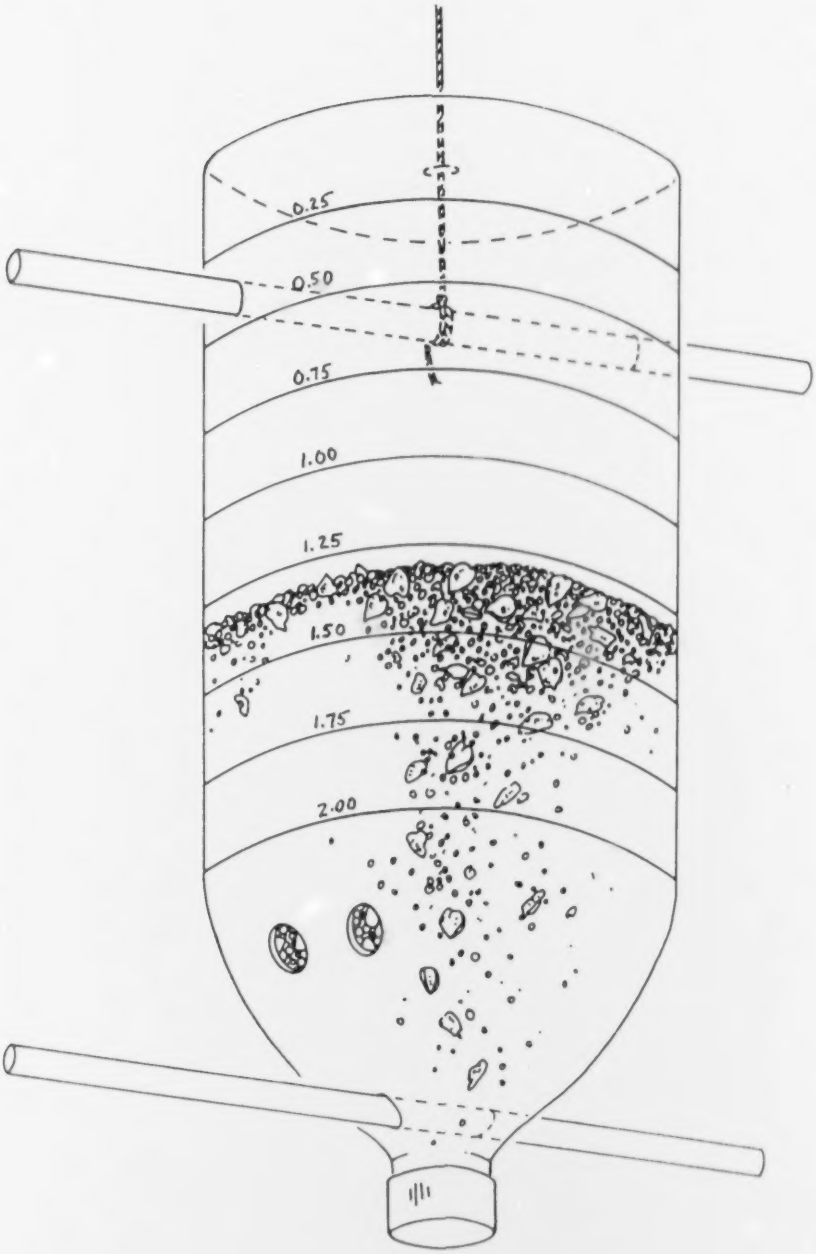
QUESTIONS FOR DISCUSSION OR JOURNAL REFLECTION

1. Why is morning the best time for observing birds?
2. What can we learn about birds from their eating habits and from their nests?
3. Did any kinds of birds eat from more than one feeder?

EXTENSION ACTIVITIES

- Invite someone from the Audubon Society, local birding club, or science center to come to class.
- Research birds that have become extinct in the last 100 years. Discuss reasons that contributed to the specie's extinction.
- Research types of birds that are endangered. Develop a plan to help save that kind of bird.
- Make nests from melted marshmallow and shredded coconut. Use food coloring to color the mixture. Put jelly beans in nests for eggs.

SODA BOTTLE BIRD FEEDER



CLASS OBSERVATIONS OF FEEDING HABITS OF BIRDS

Record the amount of seed used each day. Be sure to make observations at the same time of day.

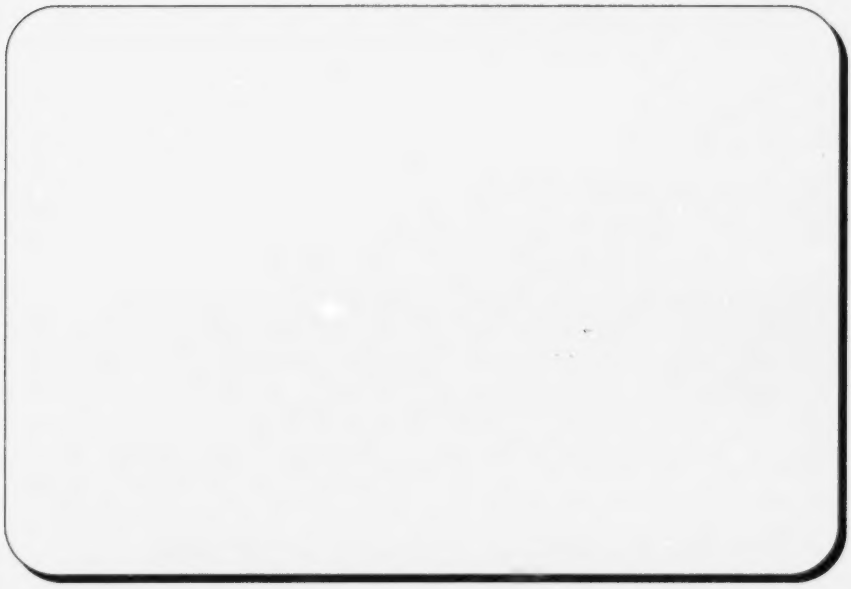
DATE	TIME	FEEDER 1 Type of Seed	FEEDER 2 Type of Seed	FEEDER 3 Type of Seed	FEEDER 4 Type of Seed	FEEDER 5 Type of Seed

OBSERVACIÓNES DE COSTUMBRES ALIMENTALES DE PÁJAROS

Documenta la cantidad de semilla utilisado cada día. Trata de hacer las observaciónes al mismo tiempo cada día.

FECHA	HORA	ALIMENTADOR 1 Tipo de semilla	ALIMENTADOR 2 Tipo de Semilla	ALIMENTADOR 3 Tipo de semilla	ALIMENTADOR 4 Tipo de semilla	ALIMENTADOR 5 Tipo de semilla

MEASURING A NEST



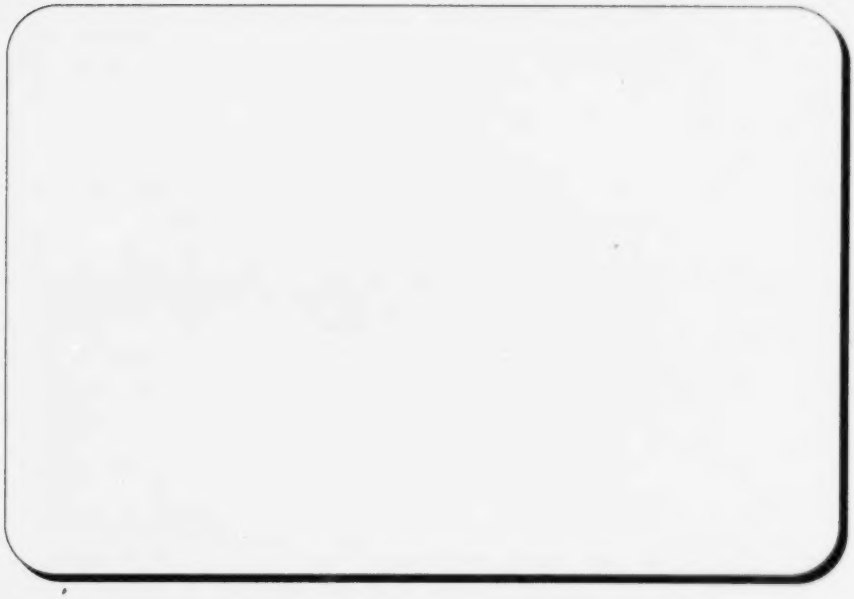
Draw a picture of your nest

	Inches	Centimeters
Circumference		
Diameter		
Height		

What materials did the bird use to build this nest?

Where do you think the bird found these materials?

MIDIENDO UN NIDO



Dibuja una imagen de su nido

	En Pulgadas	En Centímetros
Circunferencia		
Díametro		
Altura		

¿De que materiales el pájaro construyó este nido?

¿Donde piensas que el pájaro encontró estas materiales?

Observation Sheet

Kind of Bird	Number of This Kind of Bird	Time	Date	Feeder	Description of Feeding Pattern

Hoja de Observación

Clase de Pájaro	Cantidad de Este Tipo	Hora	Fecha	Alimentador	Descripción de Alimentación

INVITATION 3

YEAST AND BREAD

BACKGROUND

Yeasts are one celled micro-organisms which multiply rapidly. Strains of yeasts that cause fermentation and bread to rise are cultured for us. Fermentation results in alcohol and carbon dioxide. Yeasts used in wine-making produce higher alcohol concentration. Bakers' yeast grows rapidly, producing large amounts of carbon dioxide that causes dough to rise.

Yeast requires a warm moist environment and a source of sugar. In bread making, the sugar is found in the wheat flour starch which the yeast converts to sugar. Too much sugar slows down the growth of the yeast, and not enough will cause it to starve. As the yeast grows, it converts the starch to sugar and gives off carbon dioxide. The carbon dioxide bubbles throughout the flour mixture and makes the dough light and porous, a process commonly called "rising,"

When a liquid is added to the flour and the mixture is beaten, stirred, or kneaded, gluten is formed. Gluten enables the bread dough to hold the leavening gas, producing the lightness of breads.

CONCEPTS

- Organisms effect their environment and the environment effects organisms.
- Insects and various other organisms depend on dead plant and animal material for food.
- The survival rate of plants and animals is unique for any particular environment.
- Plants and animals depend on each other in many ways.
- **Many micro-organisms are beneficial.**

MATERIALS

- 1 liter soda bottle
- Balloon
- Kitchen thermometer
- Measuring cups and spoons
- Bowl
- Shortening
- Cookie sheet
- Oven (toaster oven works fine)
- Package of dry yeast (or cake of compressed yeast)
- 1/2 tsp. sugar
- 4 1/2 cups of flour
- 1 egg, beaten
- Coarse or Kosher salt
- Dish towel
- Sugar water: 1 part sugar to 10 parts water

PROCEDURE

1. Put some yeast in the sugar water in the soda bottle. Cover the top of bottle with a balloon.
2. Have the students record observations in their journals.

Follow the directions below or use a recipe for pretzels from a cookbook. Allow students the opportunity to make and record observations throughout the process. Encourage students to measure the size of the dough at various stages in the process. Calculate the volume of dough.

1. Put one and one quarter cups of water in a bowl. Water should be 85° Fahrenheit or 29° Celsius.
2. Add 1 package of yeast and 1/2 teaspoon of sugar. Let stand for 30 minutes. Have students record observations during the 30 minutes.

3. Using a large spoon, stir in 4 1/2 cups of flour. Knead the dough on a clean floured table or board. Keep folding the dough over and pushing it away from you with the heel of your hands, until the dough is smooth and elastic. This will take about 8-10 minutes.

4. Grease a clean bowl with shortening. Place the ball of dough in the bowl and cover it with a dish towel.

5. Place the bowl in a warm place for about one and a half hours. This should be a place free from drafts. The dough should double in this time. Have students record observations during this process.

6. Pinch off the dough into small balls. Roll each ball into a long rope and shape into a pretzel figure.

7. Place the pretzels on the greased cookie sheet. Apply a thin coating of beaten egg. Sprinkle with the coarse salt. Allow the pretzels to rise again, for about one hour. Have students record observations during this time.

8. Bake at 475° F for about ten minutes. Let cool and enjoy.

EXTENSION ACTIVITIES

- Research other micro-organisms. What is their role in the interdependence of life?
- Bake a "quick bread" such as banana or pumpkin. Discuss what interaction makes this type of bread rise? How is the bread different from yeast bread?

INVITATION 4

PLANT GROWTH IN VARIOUS SOILS

BACKGROUND

Throughout the eons, plants have adapted to a variety of environments. At any given time in history, different plants survive in one environment or perish in another. Climate, amount of sunlight, content of the air, and soil conditions all effect plant growth. In this "Invitation," we will explore the effect that different types of soils have on different kinds of plants.

Most root crops, watermelons, cantaloupe, and cucumbers grow well in sandy soils. Most grain crops, including corn, grow well in rich dark loam. Other plants seem to prefer clay. This activity can be adapted to use soil types and plants that you have readily available in your region.

CONCEPTS

- **Organisms effect their environment and the environment effects organisms.**
- Insects and various other organisms depend on dead plant and animal material for food.
- **The survival rate of plants and animals is unique for any particular environment.**
- Plants and animals depend on each other in many ways.
- Many micro-organisms are beneficial.

MATERIALS

- 4 different types of soil: for example, sandy, potting soil, humus, clay, loam
- 16 small plant pots for each group of students Bottoms of 1 liter soda bottles can be used. Put small holes in the bottom for drainage.
- 4 different kinds of seeds: bean, watermelon, and any flower seeds. Provide variety.
- Copies of page 20 or 21

PROCEDURE

For each group:

1. Fill each set of 4 containers with one type of soil. Plant the same kind of seed in each of the different kinds of soil.
2. Label each pot with the soil type and the seed type. Water the plants daily with a measured amount of water. Be sure the amount of water used is the same for each plant. Keep light conditions the same for all plants.
3. Record observations on the chart.

For older students:

Have groups vary the amount of water given each day. For example, one group should not water plants at all. One group could water daily with a small amount of water. One group could water daily with a large amount of water. Keep light conditions the same for all plants.

EXTENSION ACTIVITIES

- Take a field trip to a wooded area that is near water. Compare the trees and plants that are growing near the water with those farther from the water.
- Invite a person who owns a tree or plant nursery to visit the class.
- If you live in an area where there are farmers, invite one to visit your class and discuss the crops that grow in your area and the effect the soil has on each crop. Also discuss plant rotation.
- Design a plant that will survive in a dry climate.
- Design a plant that will survive in a wet climate.

PLANT GROWTH IN VARIOUS SOILS

Plant biologist:_____

1. Across the top of the chart, label each column with a kind of soil used.
2. Down the left column, list the kinds of seeds planted
3. Make observations in appropriate boxes on the table

SOIL TYPE

KIND OF PLANT	1	2	3	4
1				
2				
3				
4				

CRECIMIENTO DE PLANTAS EN DIVERSOS SUELOS

Biólogo de Plantas:_____

1. En la parte superior de la carta debajo, escribe, en cada columna, la clase de suelo utilizada.
2. En la columna izquierda, haga una lista de las clases de semillas plantadas.
3. Haga observaciónes en cajas apropiadas de la carta.

TIPO DE SUELO

CLASE DE PLANTA	1	2	3	4
1				
2				
3				
4				

INVITATION 5

WHAT'S YOUR BIOME?

BACKGROUND

Biomes are major ecosystems that occur over wide areas. Presently some scientists have identified seven biomes, while others have identified eight. The biomes included in both listings are: 1. tundra; 2. taiga or coniferous forest; 3. temperate deciduous forests; 4. grassland; 5. desert; 6. savannas; 7. tropical rainforests. The eight-biome system includes chaparral.

These biomes, at least in the northern hemisphere, are more or less related to latitude starting with the north pole and working toward the equator. The chaparral, however, is exclusively coastal. It is found primarily along the Pacific coast of North America and Chile, southern Africa and Australia, and in the Mediterranean.

The tundra, found only in the northern hemisphere, is characterized by permafrost, limited precipitation, and long winters.

The taiga is characterized by coniferous forests, low precipitation, and wide seasonal extremes.

The temperate deciduous forests are characterized by moderate precipitation and seasonal changes.

The grasslands are characterized by immense populations of swarming insects and grazing mammals.

The chaparral is characterized by both a flow of marine air and desert conditions.

The desert is characterized by severely limited, seasonal precipitation, usually less than 25 cm. per year.

Savannas border rain forests, have long, dry seasons, and are characterized by many fires.

Tropical rainforests have little temperature variations, heavy rainfalls, and support a great diversity of species.

CONCEPTS

- **Organisms effect their environment and the environment effects organisms.**
- Insects and various other organisms depend on dead plant and animal material for food.
- **The survival rate of plants and animals is unique for any particular environment.**
- Plants and animals depend on each other in many ways.
- Many micro-organisms are beneficial.

MATERIALS

- pictures on page 25 and 26
- magazines with a variety of animals and plants
- art supplies

PROCEDURE

1. Have students brainstorm a list of animals. Encourage a very wide variety of animals. When the list contains animals from a variety of biomes, ask students to describe the environment in which each animal is found. In order to encourage a greater diversity, you may want to use the pictures on page 25.

2. As environments are suggested, gradually sort them into seven or eight biomes. Students probably will not suggest chaparral, taiga, grasslands or savannas. This will depend on what they already know. Remember, scientists do not agree on these classification systems. Try only for approximations. Many organisms overlap territories, like mosquitoes. After discussion has continued for some time, help students by naming the eight biomes suggested in this "INVITATION." Remind students that this is only one possible way to describe the biomes.

3. When the eight biomes have more or less been identified, invite students to suggest kinds of plants that might live in each biome.
4. Arrange students into eight groups. Assign one of the types of biomes to each group.
5. The information gathered in the brainstorming is a starting point. Encourage students to verify animals and plants listed for their biome and to add other plants and animals to the list.
6. Divide the classroom into eight areas. Assign each group to one area. Invite students to create an assigned biome in the space designated. Students may use arts and crafts supplies, pictures, or whatever other material is available .
7. Discuss the characteristics of the biome where you live.

EXTENSION ACTIVITIES

- Ask students to write to friends and/or relatives who live in different biomes.
- Find pen pals who live in a different biome and exchange information about that biome.
- Identify on a world map where the biomes are generally located.

PLANTS AND ANIMALS FOUND IN EACH BIOME

The following information is primarily for the teacher's use. Some animals and plants are found in different biomes, and there are some plants and animals that rarely are found out of their natural habitat. For example, it is unlikely that a polar bear will be found in the tropical rainforest. However, some plants and animals have become "out of place" due to human intervention or other climatic or geologic events. For example, horses were introduced to the western plains of North America by the Spanish explorers.

BIOME	PLANTS	ANIMALS
RAINFOREST	more species than any other biome, i.e. rosy periwinkles, rafflesia, tualang trees, cacao trees	capybaras, spider monkeys, okapis, leaf-tailed geckos, three-toed sloths
SAVANNAH	grasses, baobab trees, palms, acacias	zebras, wildebeasts, giraffes, antelopes, lions, cheetahs, rhinoceroses, elephants, gazelles
DESERT	xerophytes: cactus, ocotillo, Joshua tree, creosote bush, sage bush, palo verde	arthopods, reptiles, birds, lizards, mammals-rodents, kangaroo rats, hawks, roadrunners, camels,
CHAPPARAL	broad leaved evergreens, plants similar to the desert types, but have adapted to fire	similar to desert animals
GRASSLANDS	prairie grasses	hooved and burrowing animals: yaks, bison, antelope, immense populations of swarming insects amd grazing mammals
DECIDUOUS	deciduous trees: beech, maple, oak, hickory	gray wolves, mountain lions, bears, bobcats, racoons, opposum, skunks, foxes
TAIGA	conifers: pine, spruce, hemlock, fir; low-lying shrubs, mosses	moose, elk, deer, grizzly bears, wolves, lynx, wolverines, rabbits; insect population small except for mosquitoes and flies
TUNDRA	lichens, mosses, grasses, rushes, sedges	caribou, musk oxen, reindeer, wolves, ptarmigan, snow shoe hares, artic ground squirrels, lemmings

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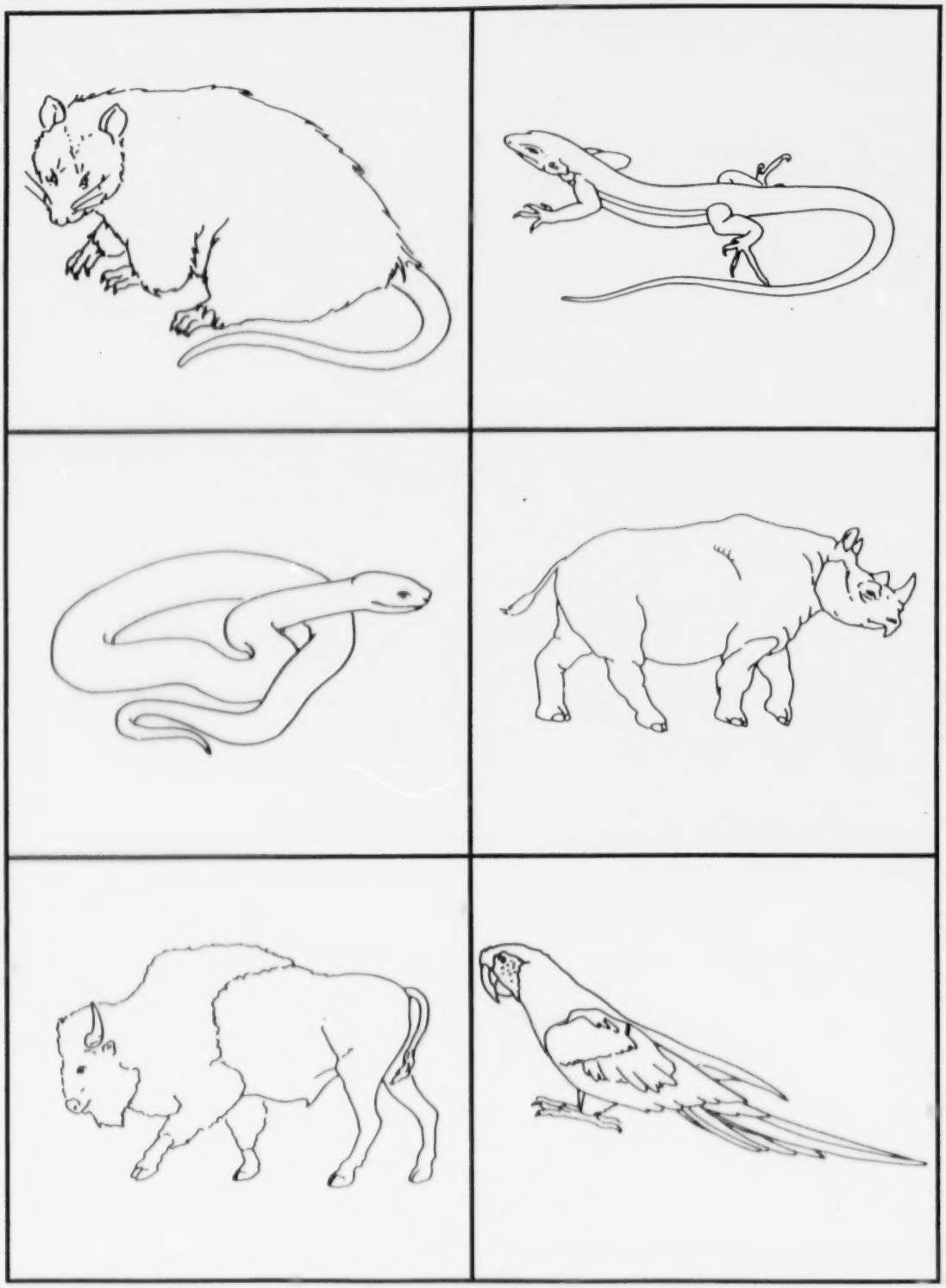

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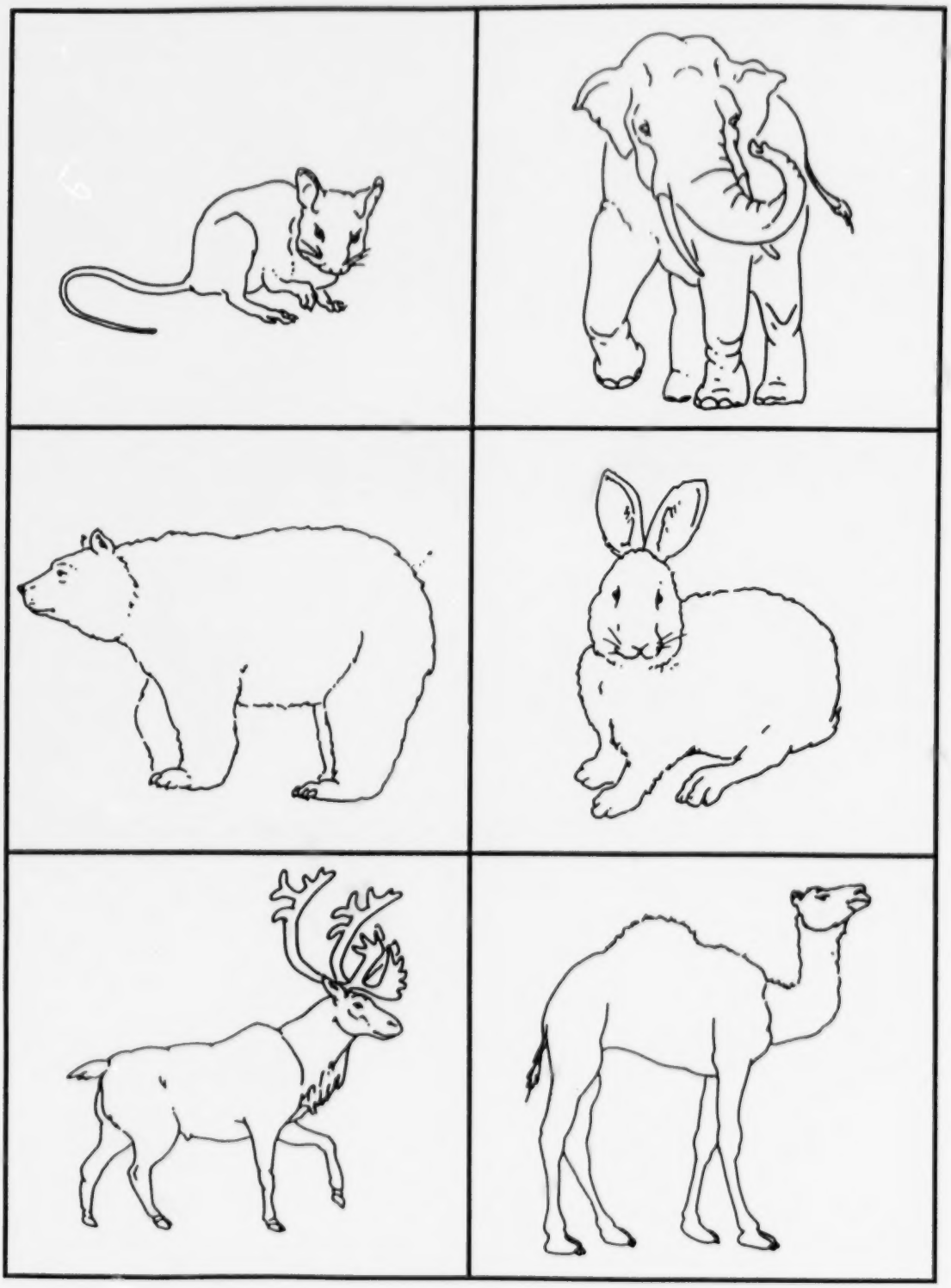


INVITATION 6

RAIN FOREST SCAVENGER HUNT

BACKGROUND

In recent years, much attention has been given to rainforests. The destruction of the rainforests will have enormous affects on all aspects of life on earth. More than 50 percent of the earth's rainforests have already been cut or burned. This kind of massive deforestation breaks the nutrient cycles that sustain the forest. Reducing the area of rainforests on the planet increases the levels of carbon dioxide in the atmosphere. This, in turn, influences global climate.

Tropical rain forests are the most diverse of all terrestrial ecosystems. More than one half of all species live in the rain forest. Many of these species are threatened with extinction.

While there are many aspects of the rain forest to be studied, it is important that the teacher stress the concept of the inter-dependence of all things.

CONCEPTS

- **Organisms effect their environment and the environment effects organisms.**
- Insects and various other organisms depend on dead plant and animal material for food.
- **The survival rate of plants and animals is unique for any particular environment.**
- Plants and animals depend on each other in many ways.
- Many micro-organisms are beneficial.

MATERIALS

- magazines that can be cut up

PROCEDURE

1. Divide the number of students by 7. Assign one of the following categories to each of the groups formed: fruits, vegetables, spices, house plants, medicines, household furnishings, and household items that are not furnishings.
2. Have students find as many products as they can that originate in the tropical rain forest in the category assigned. Students may bring in products from home, take photographs of items, draw items, or find pictures of items in magazines.
3. In a public area of your school, such as, the front lobby, cafeteria, or a library, have students set up a display of all of the products they have found that come from the rain forest.

EXTENSION ACTIVITIES

- Bring a speaker to class to speak about the importance of the tropical rain forests on our planet.
- Write to an organization that is involved with recycling.
- Invite an environmentalist to class.
- Ask students to begin a new campaign to protect our world from pollution.
- Have a "create bumper stickers to save the rain forest" contest.
- Using fabric paints or crayons, design pictures of rain forest animals for tee-shirts.

PRODUCTS THAT ORIGINATED IN THE RAIN FOREST

allspice
avocado
balloons
balls
balsa
bamboo
banana
black pepper
Brazil nuts
burlap
camphor
cardamom
cashew nuts
cayenne
chicle (chewing gum)
chili pepper
chocolate
cinnamon
cloves
cocoa
coconut
coffee
copal
dammar
erasers
ginger
gloves
grapefruit
guava
heart of palm
hoses
insulation
kapok
kola nut
lacquer
lemon
lime
macadamia nuts
mace
mahogany
mango
nutmeg
orange
papaya
paprika
passion fruit
patchouli
pineapple
plantain
quinine
rattan
rope
rosewood
rubber
rubber bands
rubber cement
sandalwood
shoes
tangerine
tapioca
tea
teak
tires
turmeric
twine
vanilla
varnish

INVITATION 7

ROTTING LOGS

BACKGROUND

The best illustrations of the decaying processes are seen in the field. Because decay involves rotting and deterioration of dead material, the smell is not conducive to the classroom on an on-going basis. However, if your location makes field observation impractical, this activity will allow for the "field" to be brought indoors.

CONCEPTS

- Organisms effect their environment and the environment effects organisms.
- **Insects and various other organisms depend on dead plant and animal material for food.**
- The survival rate of plants and animals is unique for any particular environment.
- Plants and animals depend on each other in many ways.
- **Many micro-organisms are beneficial.**

MATERIALS

- 10-gallon aquarium or similar container
- Garden soil (NOT sterilized potting soil)
- Section of rotting log from forest floor
- Several leaves and twigs

PROCEDURE

If you cannot go out into the field:

1. Cover an aquarium floor with 3-4 inches of soil. Potting soil that has been sterilized is not good for this demonstration, because the bacteria and organisms that aid in decay have mostly been processed out of the soil.
2. Find a rotting branch. When obtaining the rotting branch or log, try not to disturb the life on the log. Collect the dirt from under the log also. Place the log and the dirt in the aquarium. The section of rotting "log" can be placed on top of the soil. A few small twigs and leaves will enhance observation of the process of decay because the changes in them will be visible sooner.
3. Cover the aquarium with a screen in order to keep the decay organisms contained. Place the aquarium in an area of the room where it can be easily observed.
4. Have students record their observations in their journals over many weeks. The most visible change will take place in the leaves and twigs at first, but as time goes on, change will be observed in the log. It is also advisable to look under the log periodically in order to see the activity of the insects and molds at work underneath.

If you can go out into the field:

1. Invite students to look under a variety of logs, leaves, and twigs very carefully. Disturb the environment as little as possible. Replace any objects and organisms that have been moved.
2. Sketch one or more of the environments.
3. Return to observe and sketch the same place several times over a period of weeks or even months.

Remind students not to put anything in their mouths and to wash their hands carefully.

EXTENSION ACTIVITIES

- Write a story about the community that lives under the log.

INVITATION 8

TEA FOR PLANTS AND PLANTS FOR TEA

BACKGROUND

Composting is a natural way to recycle organic wastes. Through the process of natural decay, organic wastes are changed into a rich humus or mulch, as well as oxygen, carbon, hydrogen and nitrogen. Sixty percent of a community's solid waste is compostable. In order for composting to work efficiently, all undesirable contaminants and inorganic material must be removed. Through composting organic materials, such as food and grass clippings, communities save much needed space in landfills. In addition, the product produced by composting can be used as fertilizer. This fertilizer can be added to the soil to improve its physical, chemical, and biological properties. Compost increases the moisture holding capacity of sandy soils. It improves drainage in heavy soils and increases the soil's ability to hold and release nutrients. Microorganis[illegible] are introduced that help plants grow.

CONCEPTS

- **Organisms effect their environment and the environment effects organisms.**
- Insects and various other organisms depend on dead plant and animal material for food.
- The survival rate of plants and animals is unique for any particular environment.
- Plants and animals depend on each other in many ways.
- **Many micro-organisms are beneficial.**

MATERIALS

PART 1

- Large plastic soda bottles for each group of students
- Nylon net or stocking pieces
- Garden soil (not potting soil)
- Compost materials: leaves, grass clippings, kitchen scraps (non-meat), newspaper. This material should be in small pieces. Putting the material through a food processor speeds up the process.
- Foil

PART 2

- Containers for planting: clay pots, plastic bowls, yogurt cups
- Potting soil
- Plants for each group: 2 cactii, 2 plants requiring shade, and 2 plants requiring full sun
- "Compost tea" from Procedure, Part 1
- Handouts

PROCEDURE

For every 3 cups of garden soil, mix 2 cups of compost material.

NOTE: This activity is best done in a group of 3-4 students. Each group of students should have a bottle. However, it is also possible to do this activity as a class demonstration.

PART 1

1. Cut bottle into two parts. Invert the top of the bottle into the bottom of the bottle. See diagram on next page.
2. Add compost material to the bottle. Add water to moisten it. Cover with foil and rubber band. As the process takes place, water should be added 2-3 times a week in order to keep the contents moist. The compost "tea" collects in the bottom cup. The soil/compost mixture can be mixed periodically by removing the foil from the top bottle and stirring. NOTE: If the odor is a problem, find a

place where it can be kept without offending others.

3. Have students record observations in their journals several times over several weeks. The compost should be observed for decomposition, organism activity, mold, etc. Remind students that the aroma is also a part of the observations.

4. After each observation, remove "tea" from the bottom bottle and store in a covered container.

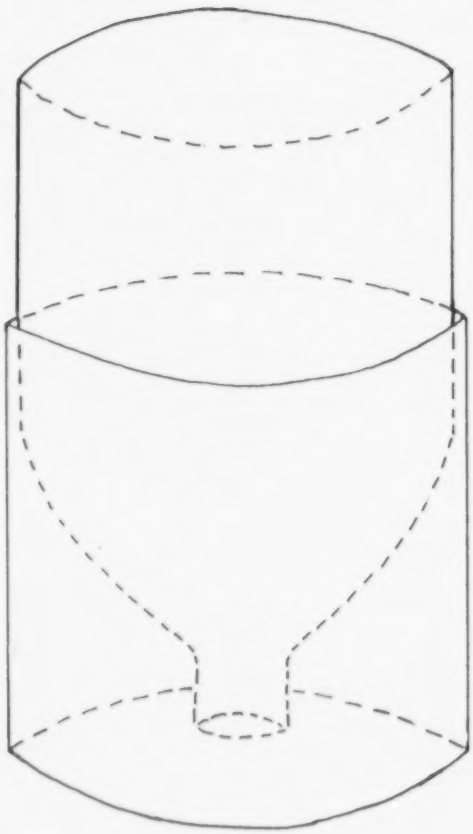
PART 2

1. Have students plant the plants. Put plants in locations that are appropriate for that kind of plant. Each group should have six plants, two of three types of plants. It is important that as many variables as possible remain constant. Try to have the type and amount of potting soil, the amount of heat and light, and the quantity of liquid in step 2, be the same for all the plants of the same type.

2. Water one of each pair of similar plants with water, the other with compost "tea" from Part 1.

3. Have the students record observations over several weeks.

4. Reflect on results, comparing and contrasting any differences that occur. Have the students compare results with other classmates.



EXTENSION ACTIVITIES

- Investigate the process of home composting, and how it can be used to improve the quality of flower and vegetable gardens.
- Find out what other students are doing in their schools to start compost piles and to re-cycle.
- Invite a sanitary engineer to talk to the class about re-cycling.
- Have the students investigate your town's recycling efforts.
- Visit the local land-fill.

OBSERVATIONS FOR PLANT "TEA"

TYPE OF PLANT	WATER	PLANT "TEA"

REFLECTIONS:

OBSERVACIÓNES PARA "TÉ DE PLANTA"

TIPO DE PLANTA	AGUA	TÉ DE PLANTA

REFLEJOS:

INVITATION 9

THE WEB

BACKGROUND

During the last few decades, it has become clear how interconnected all living things and earth processes are. Weather patterns affect how plants and animals grow and survive. How plants and animals grow and survive affects weather patterns. A volcanic eruption in the Pacific Ocean effects the weather around the world which affects food production around the world. This activity shows the interconnectedness of all things and demonstrates all of the following concepts.

CONCEPTS

- **Organisms effect their environment and the environment effects organisms.**
- **Insects and various other organisms depend on dead plant and animal material for food.**
- **The survival rate of plants and animals is unique for any particular environment.**
- **Plants and animals depend on each other in many ways.**

MATERIALS

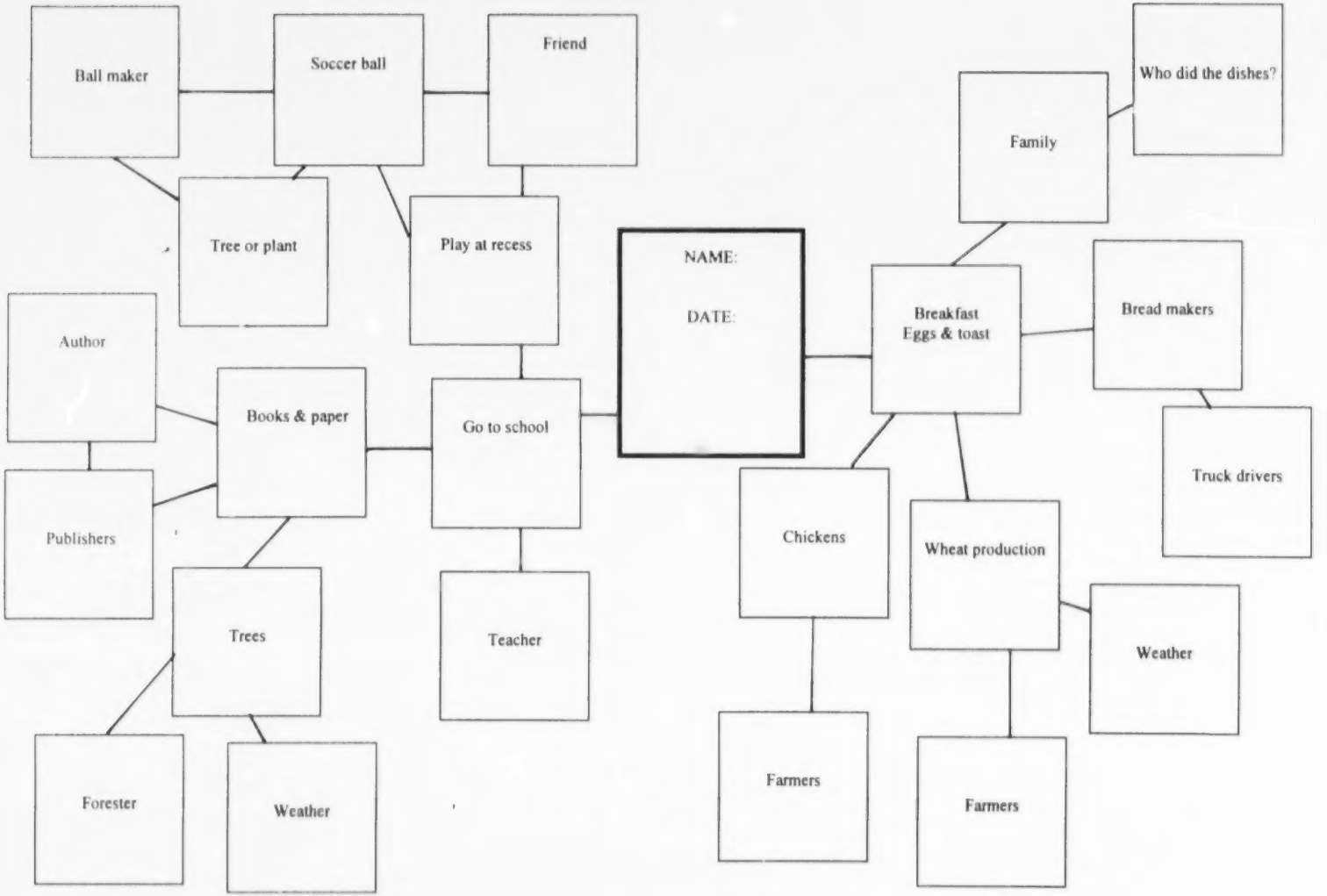
- A small ball of yarn for each student. Use a wide variety of colors.

PROCEDURE

The purpose of this activity is to create a web of yarn on the ceiling of the classroom. Depending on the design of your classroom and the rules and regulations of your school district about things hanging from the ceiling, adaptations will have to be made. The larger the web, the more graphic the illustration. This activity can also be a spare time art project.

1. Before the weaving begins, set the boundaries and the spokes of the web with yarn. Imagine a spider's web. Place 8 cup hooks or screw eyes more or less evenly spaced around the room, attaching yarn to each hook. Make spokes by attaching yarn across the room. NOTE: You can create the web just above the height of the students' heads and then raise the web up to the ceiling.
2. Give each student a ball of yarn. Tie the end of the yarn to one of the supporting strands.
3. Have students weave part of the web.
4. To extend this into a physical education activity, use one ball of yarn at a time, throwing the ball across the room but trying to get the ball to go over and under other strands that have been set. Continue adding different colors. NOTE: If you have a high tolerance for noise, have more than one ball of yarn thrown at once.
5. When the web has been sufficiently woven, have students watch carefully as you gently pull on one strand of the web. You will notice that the whole web moves and everything is affected by everything else.
6. Discuss with the students how everything on the earth and even in the universe is connected to everything else and how everything in the universe affects everything else.
7. In their journals, have the students reflect on how this concept of interconnectedness relates to their lives.
8. Have students create individual webs of one day in their lives, labeling each end of the yarn or line.

SAMPLE DAILY WEB



INVITATION 10

LIVING TOGETHER

BACKGROUND

Symbiosis means "living together." There are three kinds of symbiotic relationships: parasitism, mutualism, and commensalism.

In parasitism, the parasite lives on or near its host. The parasite gets a home and food, but the host suffers. A successful parasite takes just enough food from the host to grow and reproduce. If it kills its host, it loses its food supply and home. There are more parasites than there are free living organisms.

In mutualism, two organisms benefit from living with each other. For example, insects pollinate flowers while they are taking the nectar from the flowers.

In commensalism, one benefits and the other neither benefits nor is harmed. The remora, for example, attaches itself to a shark and eats the scraps of the shark's food, but the shark is not harmed in any way.

CONCEPTS

- Organisms effect their environment and the environment effects organisms
- Insects and various other organisms depend on dead plant and animal material for food.
- **The survival rate of plants and animals is unique for any particular environment.**
- **Plants and animals depend on each other in many ways.**
- Many micro-organisms are beneficial.

MATERIALS

- Construction paper scraps
- Cans, containers
- Miscellaneous craft scraps
- Craft supplies: clay, paints, etc.
- Copies of page 37 or 38 for each student

PROCEDURE

1. Brainstorm a list of interdependent relationships such as bees/flowers, clownfish/sea anemones, birds/crocodiles, rhinocerus/birds. Discuss each relationship and what function each organism plays in the union. Have students categorize the different kinds of relationships
2. Have students create two fictional organisms which are dependent upon each other for some vital function. These can be sketched out and embellished two-dimensionally or three-dimensionally using various art supplies. Encourage creations that demonstrate interdependence and are fictional.
3. After the students have completed their creatures, other students can try to analyze the relationship and discuss the complexities of the interdependence.

EXTENSION ACTIVITIES

- This activity naturally progresses to a creative writing assignment about these creatures. The stories could be about the evolution of this relationship and the mechanics of the cooperation between the two organisms.

TYPES OF RELATIONSHIPS

Scientist:_____

Using the list of interdependent relationships developed by you and your classmates, categorize them on the chart below.

One organism helped, the other one harmed	Organisms help each other	One organism helped, the other one not helped and not harmed	Not quite sure

Tipos De Afinidades

Científico:_____

Utilizando la lista de relaciones interdependientes desarrolladas por ustedes, clasifica a ellos en la esquema debajo.

Un organismo ayudado, el otro dañado	Los organismos se ayudan, uno al otro	Un organismo ayudado, el otro ni ayudado ni dañado	No bastante seguro

MY

SCIENCE

JOURNAL

Scientist's Name_____

MI

CUADERNO

DE

CIENCIA

Nombre del Cientifico_____

Journal Thoughts and Ideas
Invitation_____

Books I've read on this topic

Today I learned...

Cuaderno de Idéas

Sugerencias_____

Libros que he leído sobre este tema.

Aprendí hoy...

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